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Cutting Costs In Apple Packing

By D. Loyd Hunter and Joseph F. Herrick, Jr.

New equipment for apple packing plants which materially reduces costs of packaging, both in bulk and consumer-type containers, has been developed through marketing research of the U. S. Department of Agriculture.

It is a "return flow belt" for accumulating apples as they come from packing plant sizing lines. In the Pacific Northwest where it was developed, it was designed to replace rotating tub accumulators which are part of the equipment for sizing apples by weight predominately used there. While that type sizer is not so widely used in other commercial apple packing areas, the "return flow belt" accumulator should be adaptable to other sizing equipment, particularly that from which fruit flows off into bins or other receptacles before it is packed.

The chief labor-saving and cost-reducing feature of the "return flow belt" is its elimination of the manual lifting of apples from sizing line accumulators to packing containers. Furthermore, it permits the use of a mechanical packing machine directly from the sizing equipment.

Result of Continuing Research

The new equipment is the latest of several improvements in apple handling equipment to be developed through contract research, under the Agricultural Marketing Act, by USDA and the Washington State Apple Commission. The contract is administered for the Department by the Transportation and Facilities Branch of the Agricultural Marketing Service.

In packing plant tests, where the new belt accumulators were used instead of rotating tubs, reductions in labor costs ranging from 25 to 80 percent were found possible for several of the newer types of packs. For the standard Northwest pack, wrapped apples packed by count, there appeared to be no change in efficiency.

In the Northwest, as in other apple areas, recent years have brought many changes in handling methods in packing houses, particularly in the packing of new type containers such as consumer packs, tray packs using trays similar to egg fillers and loose unwrapped packs for later prepackaging or bulk sale. New equipment to handle these changes would have required heavy capital expenditures, therefore, USDA research was directed at adaptation of commonly used sizing equipment to an efficient, versatile operation that would meet new packaging needs and even permit the use of mechanical packing equipment.

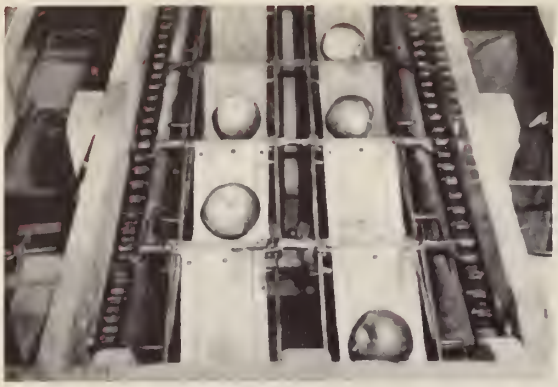


Fig. 1.--Apples rest in canvas cups as they are pulled down the sizing line.

Fig. 2.--Packing apples from accumulator tubs, now replaced by return-flow belt.

Sizing equipment universally used in Northwest apple plants is the weight type sizer illustrated above (fig. 1). After sorting, apples are run off into these canvas cups or carriers which are pulled along a track on the sizing line. Each carrier has a metal rod or arm that rides on the track. Springs are set in the track at intervals. As the carrier arm rides across them, the carriers will drop through, depending upon the weight of the apples and tension set of the springs. Fruit "weighed" by sizing in this manner rolls off into rotating tubs with retractable bottoms (fig. 2).

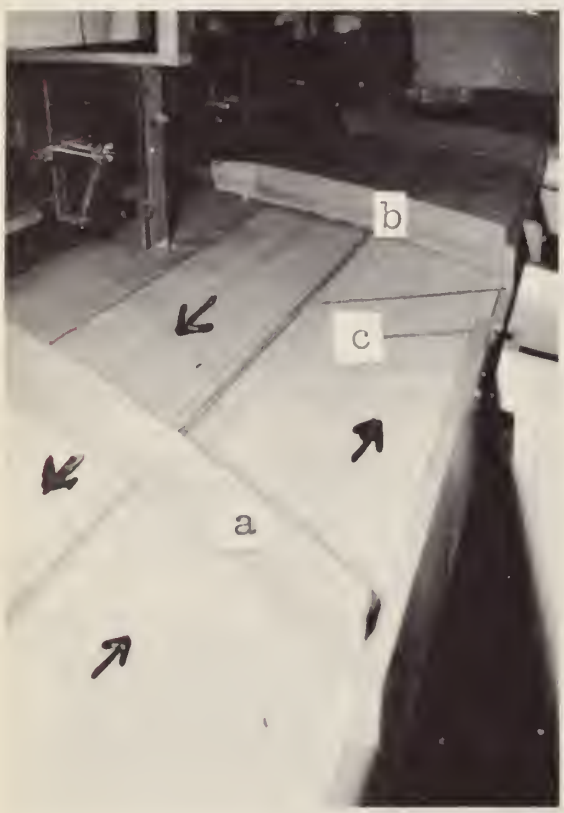


Fig. 3.--Return-flow belt; a and b are shunts, c is diversion rod.

Fig. 4.--Apples run off belt to mechanical tray packing equipment.

Fig. 5.--Standard and machine tray packing from belt accumulator.

Fig. 6.--Another tray packing arrangement from new equipment.

These tubs hold about 3 boxes of apples, the bottoms depressing under the weight of accumulated apples. In usual operations, one packer will pack apples from 3 to 5 tubs, depending upon volume of fruit.

The disadvantage of the tubs arises from the fact that fruit has to be lifted out manually for packing; so that any newer packing devices that need an automatic flow of fruit, such as for bagging or automatic packing, cannot be used.

An effective means of making the common sizer more flexible was found in the return flow belt arrangement which replaces the tubs (fig. 3). It performs the same function as the tubs, allowing a small supply of fruit to be accumulated (about $1\frac{1}{2}$ to 2 boxes). In addition, the new equipment has the great advantage of permitting transfer of fruit from belt to packing equipment without use of hand labor (fig. 4).

Essentially, the new equipment is two parallel belts moving in opposite directions; one moves the fruit in one direction, the other returns it causing a circular flow. Each size of fruit is separated by a shunt, placed diagonally across the belts (a and b in fig. 3), diverting the fruit from one belt to the other as it circulates.

Fig. 7.--Fruit bagged from accumulator tubs has to be lifted by hand.

Fig. 8.--Better method of packing from the return-flow belt.

Fig. 9.--Scoop of belting speeds loose packing from return-flow belt.

Fig. 10.--Scoop packing permits gentle transfer of loose apples to box.

To divert the fruit from the return flow belts, a small quarter inch rod (c in fig. 3) is swung across the belts. Fruit riding on the belt is deflected onto the receiving part of a tray packer (fig. 4) or to a bagging mechanism (fig. 8). If the receiving part of the tray packer becomes full, fruit will move on over the rod and continue to circulate.

Methods of packing from the return flow belts are illustrated in figures 5 and 6. Packing plant tests demonstrated that one girl, with the use of a new mechanical packer, could tray pack about a box a minute; as much as formerly done by 3 packers. This could reduce the labor cost of packing from the piece rate of 10 cents a box to about 2 or 3 cents if the packer were paid at the going hourly rate of $1.28.

Advantages of the return flow belt in bagging apples are pointed out in figures 7 and 8. In bagging from the conventional sizing line, most plants have their packers lift the apples from the tubs and place them in a bag being held open with one hand. The bag is then weighed, or, frequently, it is filled as it rests upon a scale. Packers usually are paid on a piece rate for this work - 11 cents per box. In bagging trials from the return flow belt, a set up was arranged as shown in figure 8 which eliminated the necessity of lifting the apples. Based on time studies, a worker's capacity should be about 25 percent greater using this method than when the fruit is lifted from tubs and bagged. If packers were paid at the prevailing hourly rate, cost of bagging would be 7.1 cents a box.

In addition, it was found that the belt accumulator could be used for more efficient loose filling of wood boxes or fibreboard cartons. The usual practice in many plants is to have packers lift fruit from tubs into boxes by hand. The piece work rate for this operation is $5\frac{1}{2}$ cents a box. When fruit was accumulated on a return flow belt, it was found that packers could work very efficiently filling loose boxes with the aid of a wide scoop made from a piece of belting (figures 9 and 10). A worker could lift up many apples at a time and place them in a box with very gentle handling. Loose boxes could be so filled at a rate of 60 boxes per hour. If packers were paid at the regularly hourly rate of $1.28 for this work, it would cost about 2.1 cents per box, a reduction in the normal cost of filling loose boxes of 60 percent.

Frozen Food Retailing Tips

By Dale L. Anderson and Paul F. Shaffer

Substantial increases in labor productivity are possible in the frozen food departments of retail stores through the adoption of improved handling methods and equipment developed as the result of marketing research by the U. S. Department of Agriculture.

For several years, the Transportation and Facilities Branch of the Agricultural Marketing Service has been conducting a broad research project aimed at lowering costs of food retailing. During the study it was found that in frozen food departments the amount of work accomplished by employees was quite low compared with the amount of time spent at it. Handling methods in receiving, pricing and displaying frozen foods often were poor, due in part, to the rapid growth of these departments.

In an attempt to reduce retail handling costs for frozen foods, the USDA marketing research personnel developed and reported on some new work methods and equipment modifications. In tests, these changes resulted in a 31 to 44 percent increase in labor productivity over the best conventional methods then in use. The new methods and modifications were tested in additional stores in 1954.

As these improvements were installed and personnel trained in their use, handling principles or "tips" were developed for use by the store manager and the man taking care of the frozen food department. They are as follows:

FOR THE MANAGER

1. Make one man responsible for frozen food.--In only a very few stores are frozen food departments large enough to require full-time personnel. Therefore, there is often a tendency to use for handling frozen food anyone who is not working. This results in considerable confusion, lost stock, and disorderly displays. The first requirement of a good department is to make one person responsible for it.

2. Teach him to do the job properly.--This person should make out the orders, receive the loads, build the displays, and do most, if not all, of the stocking. It is usually necessary for him to have several other duties in addition to his work on frozen food. If he is expected to do the job effectively, he should be taught how.

3. Check periodically to see that the job is done right.--Follow-up is essential in the success of any operation.

Fig. 1.--Carton cut to expose unfrosted edge of packages.

FOR THE FROZEN FOOD MAN

Receiving

1. Be ready for the load.-- A third or more of delivery drivers' time at stores was spent waiting for store personnel to get ready to receive the load. A definite time for deliveries, with store personnel ready to handle them, will speed this operation considerably and reduce congestion in delivery area.

2. Segregate items that can go directly into display case.-- Approximately a third of the items received with twice-a-week delivery can be put directly into the cases, reducing amount of handling into and out of storage and, in effect, decreasing amount of storage space needed. This requires that display cases be checked before the order is received.

3. Stack cartons closely together.-- When this is done, there is little or no air space left between cartons and thawing is minimized, quality is maintained, and reduced frosting makes price-marking easier.

4. Unload the order quickly and get it back under refrigeration.-- This is important from a quality standpoint, makes price-marking easier because of less frosting, and reduces load on refrigerating equipment.

Handling in Storage Freezers

1. Segregate merchandise as it is put away.-- Searching for an item and moving cartons to get to it requires considerable time. Orderly freezers, with merchandise stored by commodity groups, reduced handling time by a third in test stores.

2. Keep labels visible or mark visible ends of cartons.-- This aids in spotting required cartons immediately and in walk-in freezers it is possible to obtain several cartons without having to don heavy clothing or leave the door open for long periods.

3. Push carts into large walk-in freezers to load or unload.-- With the cart in the freezer, or at least in the doorway, temperature rise can be prevented and less handling is required. Each carton can be placed on the cart where needed. This practice makes unloading easier for one man and makes unnecessary the help of a second man to pass the merchandise into the freezer.

4. Load the cart with merchandise in the same order it is to be displayed.-- This reduces travel at the display case. By stacking the merchandise on the cart according to the commodity sections of the display cases, the operator can display all of the items in one section of the case without backtracking or moving merchandise around on the cart.

5. Keep the freezer clean and free of ice.-- When ice is allowed to form in freezers it results in extra handling of merchandise, loss in effective refrigeration, and loss of usable storage space. It also causes damage to merchandise, especially paper covered packages.

6. Don't collect antiques in your freezer.-- When cartons are lost or misplaced in the freezer for long periods, the merchandise tends to become damaged or discolored. In addition, quality often suffers.

Care of Displays

1. Check the display case at least twice a day.--Normal customer handling will upset displays even if they do not need to be refilled. During heavy sales periods, more frequent care may be necessary.

2. Handle full or half cartons only.--Handling individual packages or returning part cartons to the back room is time-consuming and often results in damage to the packages. In most modern display cases, this is not necessary if proper care is exercised.

3. Make a written list of needs as the case is checked.-- The operator should make a list of needs as he moves the length of the cases. Where this was not done, the operator usually had to make an extra trip to get forgotten items. Considerable success was obtained by using an inventory record on which the quantity on hand in the storage freezer, the quantity displayed each time, and weekly use were noted. The operator used this sheet to list his needs and checked them off as the items were displayed. It also was useful in making out frozen food orders.

4. Straighten out and police the cases while checking.--When the operator moves down the cases listing needed items, he can also police and straighten more effectively. This makes stocking easier later on, and he can better estimate his needs for new stock.

Fig. 2.--Pricing unfrosted ends of packages in cut carton.

Fig. 3.--Types of improved case dividers constructed of nonmetallic materials.

5. Watch for damaged packages and remove them. A damaged package or can on top of a display can effectively stop the sale of the whole stack on which it rests. Customers tend to avoid it and often will leave the entire display alone until it is removed.

6. Keep price signs clean and up to date.-- Common sense should indicate this, but it requires constant attention and is a common error in many stores.

7. Keep cases clean and free of ice.-- This also is a common mistake made in many departments. The argument usually is given that the equipment is faulty, but closer examination usually shows overloaded displays or blocked air vents have caused the difficulty. Ice in the cases can damage many packages.

Price Marking

1. Use good stamp set and keep it clean.-- It was found that about 30 stamps would provide 95 percent of the prices necessary for frozen food in most stores. The best productivity and the clearest prices were obtained by using a multi-impression stick stamp set of about 30 stamps, with an adjustable stamp for the remaining odd prices.

2. Price the whole carton at once on frost-free inside edges.-- It was found that surfaces of packages and cans which were not against the outside of the carton tended to be frost-free when the carton was first opened. Practically all cartons can be split so that the inside edges of all the cartons can be exposed (fig. 1). These can then be priced in one operation before frost forms. Open one top flap of the case containing paper-covered packages and pull the cardboard away from the packages as it is cut. Some cartons, such as some canned juices, have only one layer of merchandise. When frost occurs, it should be wiped off so that clear impressions can be obtained.

3. Price the carton quickly.-- Once a carton is opened, frost forms fast. Using proper price marking methods, the carton should be priced before the frost forms.

4. Price in the back room if possible.-- It has several advantages: (a) it allows the carton to be priced before frost forms; (b) considerably less time is spent in front of the display cases and thus aisles

and displays are blocked less; (c) a proper work place for tools and materials can be set up; (d) prices are taken from the price book, which prevents multiplied errors and forgotten price changes; and (e) it allows the ink on the price marks to dry before the item is displayed.

Display and Stocking

1. Use dump displays where possible.--Not only do dump displays save considerable time for fast-moving items, but they also permit the operator to sell more merchandise in a given space. By using dump displays, the operator can keep merchandise in a relatively small display with little effort. This would not be possible were each item individually placed on display. In the regular display cases, dump displays should not be attempted with less space than that required for three regular rows of merchandise.

2. Keep displays of half a row or more per item if consistent with merchandising practice.-- With the exception of a few slower moving items such as fish fillets, where related item can be stocked together, a minimum display for handling ease is half a row. This allows the operator to stock a half or whole carton without returning excess merchandise to the storage freezer. It also helps prevent the covering of one item by another through customer handling.

3. Keep packages facing the front.-- This results in easier handling and a better view of the package in the case.

4. Don't stock the merchandise too tightly into the case.-- Displays which are too tight take considerably longer to stock, make it difficult for customers to obtain the merchandise, and often result in torn packages and bent cans.

5. Don't backtrack; service as you go.-- In most stores there is a considerable amount of excess travel by stockmen going up and down the cases to find a certain display. With merchandise segregated on the display cart, the operator need move the length of the cases only once in filling displays.

Fig. 4.--Front view of package display when improved dividers are used.

6. Don't block the the case with carts or empty cartons.-- With merchandise price-marked in the back room and segregated properly on the cart, it is often pos-

Fig. 5.--Proper method of stocking case. Note carton placed in case, stocking with two hands and use of dividers.

sible to park the cart away from the cases when stocking so that customers have access to cases.

7. Combine rotation with stocking.-- This can be done by moving old merchandise to the front and stocking to the rear of each row. Most of the moving of the old merchandise forward should be done when policing cases prior to stocking.

8. Get the carton up to the display.--Best production was obtained when operators placed the carton in the case for stocking.

9. Use both hands effectively.-- Frozen food can be stocked rapidly by using both hands. The best method is to lift the merchandise from the carton two or three units at a time with one hand and transfer them to the other in the proper position to be placed in the display. Special dividers and the split carton method were a great help in stocking.

10. Keep displays below fill line of display cases.-- Displays above the maximum fill line are disorderly and a major cause of ice in cases.

11. Use the improved dividers.-- Special dividers were developed during the USDA research which were a great aid to displaying and stocking frozen food. These consisted of solid sheets of nonmetallic materials inserted between all rows of merchandise (fig. 3). They extended from the bottom of the case up to within 3 or 4 inches of the fill line. These dividers have the following advantages: (a) Stocking is much easier Cans will slide into position when placed between the two dividers. Packages can be moved freely into position without catching on other packages or the wire in conventional dividers. (b) Cases are kept neat by the dividers, as packages or cans don't topple or slide. (c) Rotation is simplified. With cans, rotation consists of merely scooping the remaining portion of the display to the front with one hand. (d) With wedging eliminated, it is easier for the customer to get the item out of the display. It is often difficult to obtain an item from a row of merchandise lower than the two adjoining ones. With solid dividers, the item slides out easily. (e) Solid dividers conserve space. When these special dividers were used, space was gained in some cases. The tendency of the rims of cans to extend beyond the can below results in telescoping of rows. If the rows are allowed enough space so that the items are not locked into the displays, considerable loss of space results. With the dividers, each item was directly above the item below, often reducing the space between rows more than was required for the dividers.

Poultry Plant Waste Disposal

By Humbert S. Kahle

"Poultry waste disposal" to the general public often means objectionable odors, flies, and lack of sanitation. It is, in a sense, garbage of a very perishable and objectionable nature. For law makers it means legislation for the protection of the public health and welfare and the sanitary processing of food. For the poultry industry, waste disposal means a loss of a part of the poultry purchased and expense for handling it. Only in concentrated production areas does the disposition mean added income to the poultry slaughterer.

The importance of the waste disposal problem has increased with the growth of the poultry industry. This is due not only to the increase in the quantities of waste involved, but to the concentration of these quantities locally as the size of individual processing plants increased.

In 1953, over 3 billion pounds of broilers were sold from farms. If the inedible portion of these broilers (approximately 1 billion pounds) had been processed, about 300 million pounds of high protein feed and grease would have been obtained. At 1954 prices, this waste (raw offal and feathers) would have been worth 3 million dollars to poultry slaughterers. For individual processors it would have meant an additional $3.00 per thousand broilers slaughtered; enough, ordinarily, to more than offset expenses of handling the waste. With today's keen competition, failure to recover this amount could substantially affect a firm's profit.

Salvage of Inedible Products

Currently the utilization of waste is complete only in the most concentrated production areas. In the Delmarva, Shenandoah Valley, and Georgia commercial broiler producing areas, for example, all inedible products are usually salvaged. This includes heads, feet, viscera, blood, and feathers. In less concentrated areas, heads, feet, and viscera are salvaged, but feathers, and sometimes blood, are spread on nearby farm lands. In the least concentrated areas, heads, feet, and viscera are also handled in this manner, or fed to hogs.

Where they are fully utilized, payment usually is made for feathers as well as for offal. In areas where plants are some distance from renderers, only offal is saleable. In areas where plants are least concentrated, sale of the waste is not possible. Payments for waste apparently depend upon two factors; (1) Only the largest renderers are equipped for low-cost processing and efficient marketing of waste byproducts. They

are found only in areas where poultry slaughterers are large and numerous. (2) Transportation is an important item. Since 3 or 4 tons of raw waste must be collected for every ton of byproducts, hauling costs add up. With these costs in the neighborhood of 20 cents per mile (figuring depreciation, insurance, repairs, gas, oil, driver and other expenses) and with yields of only a ton from the offal collected on one trip by a truck with a rated capacity of $1\frac{1}{2}$ tons, costs of collection can easily amount to $12 to $15 per ton of byproduct unless plants are close to the renderer. When less-than-truck-loads are picked up, costs increase still more and small slaughterers may not receive any payment for their wastes.

Yields of inedible products will vary depending upon practices followed in the slaughtering plant and the rendering plant, but the following are believed to be typical for poultry having a ready-to-cook yield of 70-72 percent of the live weight.

Estimated yields of inedible products from poultry processing

Raw offal			Processed offal		
Item	Percentage of live weight	Pounds per 1,000 broilers (3½ pounds live weight)	Item	Percentage of uncooked offal weight	Pounds per 1,000 broilers (3½ pounds live weight)
Heads	3.0	105			
Feet	5.0	175	Dry tankage	27.0	194
Viscera	10.5	368	Grease	4.5	32
Free moisture*	2.0	70			
Total offal	20.5	718	Total	31.5	226
Feathers (dry)	7.6	266			
Free moisture*	3.8	133			
Wet feathers	11.4	399	Feather tankage	25.0	100
Blood	3.7	130	Blood meal	12.5	16

* Water picked up from scalding tank or spray wash while dressing or eviscerating

In addition to tankage, grease, and blood meal, other byproducts are processed from poultry offal by a few renderers. Some offal is used in the manufacture of pet food and in food for fur bearing animals. Feathers are cleaned for bedding or industrial uses in such items as plastics, paint brushes, and other products.

What does the future hold for those interested in waste disposal? Many operators wonder whether salvage of poultry wastes will pay enough to offset processing costs as has been the case in waste disposal in the meat packing industry. Naturally, they are all interested in turning a loss into a profit, if it is possible.

The first step in exploring possibilities of offsetting processing costs with income from salvageable waste is to compare those costs on a dressed weight basis. While these costs are not available from commercial processing plants, an example of relative costs can be based on the slaughter charges of frozen food locker plants. Averages for 1947 amounted to 8¢ per lb. for chicken, 3¢ for turkeys, $4\frac{1}{2}$¢ for sheep, $2\frac{1}{4}$¢ for

calves, $1\frac{1}{4}¢$ for hogs and $\frac{1}{2}¢$ per lb. for beef cattle. Notice how costs per pound decrease as animal size increases and how expensive it is to process poultry. The second step in such a study is to consider the type and relative yields of byproducts. For a chicken these are small - in the aggregate as well as in terms of specific organs. The kidney of a broiler for example weighs less than 1/3 oz. The kidney of a steer will weigh 1-3/4 lbs. The entire head of a broiler weighs about $1\frac{1}{2}$ oz. - for a steer, the tongue alone weighs $6\frac{1}{2}$ lbs. This difference in the weight of the individual organs accounts for the fact that there is careful separation of steer organs - none in the case of poultry except the edible giblets. The entire head, intestinal tract, and the feet are classed as inedible by the poultry processor. Any recovery of byproducts must be from the aggregate rather than from individual organs.

Research Needed and Underway

In view of the above, it becomes clear that the possibility of offsetting processing costs with income from poultry byproducts is remote with present techniques of waste recovery. Waste products worth scarcely a cent per bird are of low value compared with processing costs of up to 20¢ or so. We can, however, seek ways to maximize income from byproducts and reduce costs of handling such products. Additional research should therefore be directed at the following objectives:

1. More efficient methods of processing small volumes of inedible products so as to more fully utilize such materials in areas of low concentration of slaughtering plants. This might also serve to reduce transportation costs and thus increase returns to slaughterers.

2. New uses for inedible products. It is possible that some edible products might be prepared from the feet and shanks or that a product having special properties might come from the offal. New uses for feathers or for substances derived from feathers also may be discovered.

3. An evaluation of byproducts from poultry slaughtering plants by feeding trials and other tests to develop information that will improve public acceptance of such byproducts.

4. Improved markets for poultry byproducts.

5. An economic analysis of factors which provide a basis for selecting the most practicable alternative in planning for the salvage of inedible portions.

Currently, the United States Department of Agriculture is engaged in, or is planning, work in all of these fields. Technical research is underway at the Western Regional Laboratory. At Washington, economists are making a preliminary survey to determine the nature and extent of waste materials and their present utilization. Work is planned in the field of market development for byproducts. Additional research in other fields will be planned as these preliminary studies establish its need.

New Load Method Cuts Watermelon Losses

By P. L. Breakiron, J. R. Winston and J. Kaufman

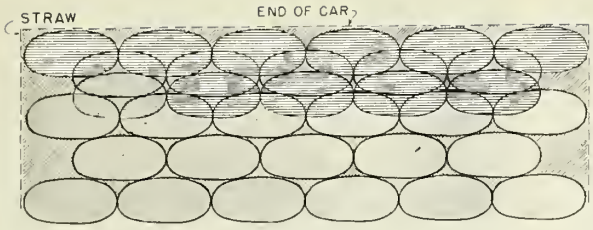
More than one out of every 10 Congo watermelons shipped by rail from the Southeast to northern markets during the past two years has gone to the garbage dump instead of the consumer's table because of loss and damage during transportation. In terms of the actual number of melons involved, the loss amounted to an average of about 126 melons per car, a total of approximately 750,000 melons per year, or an equivalent of more than 700 carloads.

The waste of marketable melons, transportation and productive effort is of particular significance to watermelon growers and consumers, as in the long run it is reflected in the price that the grower receives for his melons and in the price that the consumer pays for them.

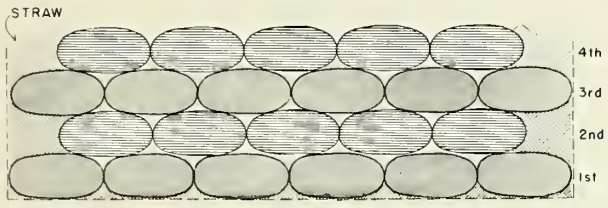
Fortunately, however, research has come up with an answer to this problem in the form of a new loading method which shipping tests have indicated can reduce transit losses for the Congo type of melon by more than two-thirds. This new crosswise load can be used by growers and shippers of watermelons without added expense for labor or materials. The new loading method is the result of a two-year program of shipping experiments, which involved a total of 220 cars of melons, conducted by workers of the Agricultural Marketing Service in cooperation with the agricultural experiment stations of Florida, Georgia and South Carolina and a number of participating railroads.

New Varieties Susceptible to Damage

Although watermelons have always sustained considerable damage during rail shipment, the problem became particularly acute during the recent years with increased shipments of the new Congo variety from the Southeast. The new variety, which has become increasingly popular with growers and consumers, was developed by plant breeders of the U. S. Department of Agriculture. The melon is resistant to anthracnose, a serious field disease, is a comparatively prolific producer, and has excellent eating qualities. However, because the Congo has a comparatively thin and somewhat flexible rind at the blossom end of the melon, excessive bruising occurs to this area of the melon in the conventional lengthwise loads during rail shipment. During the 1952 season, for example, 3,404 cars of the Congo variety suffered 10.3 percent damage from bruising and cracking as compared with only 5.2 percent damage from the same causes found in 9,268 cars of the Cannonball variety, which the Congo has supplanted to a large extent in many shipping areas in the Southeast.



TOP VIEW



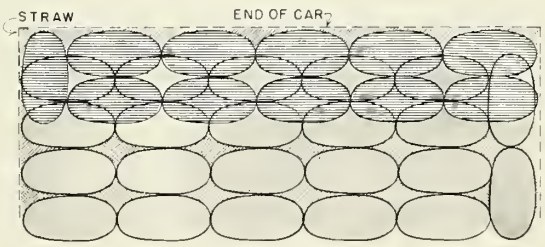
END VIEW

Top and end views of a crosswise load of long-type melons with all melons loaded crosswise of the car. In the top view, two lines or stacks of melons are superimposed upon the first, or bottom, layer of the melons.

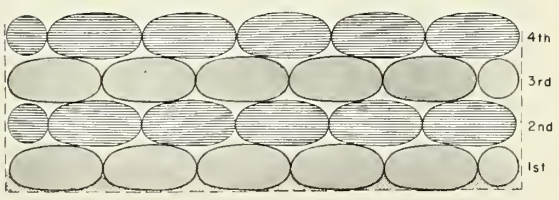
Note that in the top view the melons in the second layer are crosswise and lengthwise offset from those in the bottom layer as they rest in the depressions between the melons in the bottom layer.

Top and end views of a crosswise load of long-type melons with one lengthwise row of melons along alternate sides of each layer. This particular load pattern does not protect the melons as well as the all-crosswise pattern.

Shipping tests during the 1954 season showed that shipments loaded with this pattern sustained about twice as much damage as those in which the all-crosswise pattern was used.



TOP VIEW



END VIEW

Indications are that production of the Congo and two other improved varieties of long-type melons, namely the Fairfax and Charleston Grey varieties, recently introduced in the Southeast, will increase substantially in the next few years. The two last named varieties, having the same general shape and rind characteristics as the Congo, are also highly susceptible to blossom end bruising. It was apparent at the time the shipping experiments were begun early in the 1953 season that a different, yet practicable, method of loading the new varieties of melons that would provide effective protection against transportation hazards would have to be developed if the full economic benefits were to be realized from their superior productivity and quality.

Crosswise Loading is Successful

In the conventional lengthwise load, which has been used almost universally for watermelon shipments for many years, the melons are all loaded with their blossom ends pointing towards the ends of the car and their stem ends toward the center. In this position the hard stem end of each melon contacted the comparatively weak blossom end of the melon next to it. The impacts transmitted to the load from the car body during transit caused severe blossom end bruising. It was observed that more than 90 percent of all damage in lengthwise loads of Congos consisted of blossom end bruising.

Measurements of the rind thickness of the Congo variety showed the rind at the blossom end of some melons, particularly the more mature melons, to be as little as 1/16 of an inch, averaging about 3/16 of an inch, as compared with the thickness of $\frac{1}{2}$ inch or more on the sides of the melons. It was also observed that there was a relatively small area of contact between the stem ends and blossom ends of melons in the conventional lengthwise loads as compared to that which could be obtained by placing these long melons side by side. These observations made it clear that if the melons could be loaded crosswise, the lengthwise impacts transmitted to the load could be spread over a much larger area of thick rind on the sides of the melons instead of being concentrated on a relatively small area of thin, weak rind at the blossom ends.

Shipping experiments during the 1953 and 1954 seasons proved this analysis to be correct. For 109 crosswise test loads shipped and handled under normal commercial conditions the number of bruised melons averaged 35.6 per car as compared with an average of 125.3 bruised in 111 conventional lengthwise check loads of comparable melons. The same shipping tests showed an average of 3.3 cracked melons per car and 2.5 melons scarred in the crosswise loads as against 9.9 cracked and 3.6 scarred in the lengthwise loads. Overall reductions for each type of damage for the crosswise loads as compared with the lengthwise loads averaged 69.4 percent in bruising, 70 percent in cracking and 33.3 percent in the number of scarred melons. Total damage for each type of load averaged 4.2 percent, or 41.4 melons per car for the crosswise loads as contrasted with 13.4 percent, or 138.8 melons per car for the conventional lengthwise loads. The overall reduction in total damage was 68.7 percent. Also of significance was the fact that the 109 crosswise loads averaged 14.3 decayed melons per car as against 23.2 melons in the 111 comparable

Paint on side of this Congo melon shows wide contact area in crosswise load. Painted side of another melon was placed against it.

Paint on thin blossom end of melon showing concentrated contact in lengthwise load. Painted end of another melon made the spot.

lengthwise loads, a reduction of more than 30 percent.

Other Results

Observations made during both the 1953 and 1954 shipping seasons indicated that the same amount of straw can be used to bed and pack the new crosswise load as is required for the conventional lengthwise load. Limited time studies of loading operations by workers of the South Carolina Agricultural Experiment Station in 1954 disclosed that once the loaders became familiar with the new load, they could load the melons about as quickly as they could in the lengthwise load.

Further observations of unloading operations at terminal markets also indicated that the crosswise shipments were somewhat easier to unload than the conventional lengthwise loads as the crosswise melons in the new load with their ends pointing towards the sides of the car were in a position where they could be grasped more easily by the unloaders.

During the 1954 season comparisons were made between several different loading patterns that could be used for the new crosswise load. Results of these shipping experiments disclosed that 22 cars in which all melons were loaded crosswise sustained 2.2 percent damage, only half as much as the 4.4 percent damage found in 37 crosswise loads in which one side wall row of melons in two or more layers were arranged lengthwise of the car.

Cooperating state experiment station workers selected sample melons for internal inspection at the time the cars were loaded and additional sample melons were selected and examined after the cars reached their destinations. These examinations revealed that internal bruising and cracking of the flesh was more closely related to the maturity of the melons at time of shipment than to the loading method used. Total damage was found to be greater in melons from the third and later pickings of the crop than in those shipments from the first and second pickings. In the case of melons from both early and late pickings, however, those loaded by the crosswise method sustained only about 1/3 as much damage as those shipped in the conventional lengthwise load.

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